

WHAT IS CLAIMED IS:

1           1.       A method for forming self-pinned abutted junction heads, comprising:  
2               forming a first self-pinned layer having a first magnetic orientation, the first layer  
3   having a first end, a second end and central portion;  
4               forming a second self-pinned layer over only the central portion of the first self-  
5   pinned layer, an interlayer being disposed between the first and second self-pinned  
6   layers;  
7               forming a free layer in a central region over the second self-pinned layer; and  
8               forming a first and second hard bias layers over the first and second ends of the  
9   first self-pinned layer respectively, the first and second hard bias layer abutting the free  
10   layer, the first and second end of the first self-pinned layer extending under the hard bias  
11   layers at the first and second ends.

1           2.       The method of claim 1 further comprising forming a spacer layer over the  
2   first self-pinned layer and forming a first and second seed layer between the first and  
3   second hard bias layer and the spacer layer.

1           3.       The method of claim 2 further comprising forming amorphous layers  
2   between the spacer and the first and second seed layers, the amorphous layer stopping  
3   epitaxial growth between the first self-pinned layer and the first and second hard bias  
4   layers.

1           4.       The method of claim 1 further comprising forming amorphous layers  
2 between the first self-pinned layer and the first and second hard bias layers for stopping  
3 epitaxial growth between the first self-pinned layer and the first and second hard bias  
4 layers.

1           5.       The method of claim 1 further comprising forming first and second leads  
2 over the first and second hard bias layers.

1           6.       The method of claim 1, wherein the forming the first and second hard bias  
2 layers further comprises electrically coupling the first and second hard bias layers to the  
3 free layer to allow sense current to pass through the free layer.

1           7.       The method of claim 1, wherein forming the first and second hard bias  
2 layers over the first self-pinned layer further comprises providing a coupling of the self-  
3 pinned layers and the free layer to the first and second hard bias layers, the first and  
4 second hard bias layers being cooler than the central region to maintain pinning of the  
5 first and second hard bias layers, the maintenance of the pinning of the first and second  
6 hard bias layers maintaining the pinning of the free layer.

1           8.       The method of claim 1, wherein the forming the free layer further  
2 comprises forming the free layer with a length selected for a desired track width.

1           9.       A self-pinned abutted junction magnetic read sensor, comprising:  
2           a first self-pinned layer having a first magnetic orientation, the first self-pinned  
3           layer having a first end, a second end and central portion;  
4           a second self-pinned layer formed over only the central portion of the first self-  
5           pinned layer, an interlayer being disposed between the first and second self-pinned  
6           layers;  
7           a free layer formed in a central region over the second self-pinned layer; and  
8           a first and second hard bias layers formed over the first and second ends of the  
9           first self-pinned layer respectively, the first and second hard bias layer abutting the free  
10          layer, the first and second end of the first self-pinned layer extending under the hard bias  
11          layers at the first and second ends.

1           10.      The sensor of claim 8 further comprising a spacer layer formed over the  
2           first self-pinned layer and a first and second seed layer disposed between the first and  
3           second hard bias layer and the spacer layer.

1           11.      The sensor of claim 9 further comprising amorphous layers formed  
2           between the spacer and the first and second seed layers, the amorphous layer stopping  
3           epitaxial growth between the first self-pinned layer and the first and second hard bias  
4           layers.

1           12.     The sensor of claim 8 further comprising amorphous layers formed  
2     between the first self-pinned layer and the first and second hard bias layers for stopping  
3     epitaxial growth between the first self-pinned layer and the first and second hard bias  
4     layers.

1           13.     The sensor of claim 8 further comprising first and second leads formed  
2     over the first and second hard bias layers.

1           14.     The sensor of claim 8, wherein the first and second hard bias layers are  
2     electrically coupled to the free layer to allow sense current to pass through the free layer.

1           15.     The sensor of claim 8, wherein the first and second hard bias layers are  
2     cooler than the central region to providing stable pinning of the free layer.

1           16.     The sensor of claim 8, wherein the free layer includes a length selected for  
2     a desired track width.

1           17.     A magnetic storage system, comprising:  
2           a moveable magnetic storage medium for storing data thereon;  
3           an actuator positionable relative to the moveable magnetic storage medium; and  
4           a magnetoresistive sensor, coupled to the actuator, for reading data from the  
5 magnetic recording medium when position to a desired location by the actuator, wherein  
6 the magnetoresistive sensor further comprises:  
7                     a first self-pinned layer having a first magnetic orientation, the first self-  
8 pinned layer having a first end, a second end and central portion;  
9                     a second self-pinned layer formed over only the central portion of the first  
10 self-pinned layer, an interlayer being disposed between the first and second self-pinned  
11 layers;  
12                     a free layer formed in a central region over the second self-pinned layer;  
13 and  
14                     a first and second hard bias layers formed over the first and second ends of  
15 the first self-pinned layer respectively, the first and second hard bias layer abutting the  
16 free layer, the first and second end of the first self-pinned layer extending under the hard  
17 bias layers at the first and second ends.

1           18.     The magnetic storage system of claim 14 further comprising a spacer layer  
2 formed over the first self-pinned layer and a first and second seed layer disposed between  
3 the first and second hard bias layer and the spacer layer.

1           19.     The sensor of claim 15 further comprising amorphous layers formed  
2     between the spacer and the first and second seed layers, the amorphous layer stopping  
3     epitaxial growth between the first self-pinned layer and the first and second hard bias  
4     layers.

1           20.     The sensor of claim 14 further comprising amorphous layers formed  
2     between the first self-pinned layer and the first and second hard bias layers for stopping  
3     epitaxial growth between the first self-pinned layer and the first and second hard bias  
4     layers.

1           21.     The magnetic storage system of claim 14 further comprising first and  
2     second leads formed over the first and second hard bias layers.

1           22.     The magnetic storage system of claim 14, wherein the first and second  
2     hard bias layers are electrically coupled to the free layer to allow sense current to pass  
3     through the free layer.

1           23.     The magnetic storage system of claim 14, wherein the first and second  
2     hard bias layers are cooler than the central region to providing stable pinning of the free  
3     layer.

1           24.     The magnetic storage system of claim 14, wherein the free layer includes a  
2     length selected for a desired track width.

1           25.     A self-pinned abutted junction magnetic read sensor, comprising:  
2           a first means for providing a first self-pinned layer having a first magnetic  
3     orientation, the first means having a first end, a second end and central portion;  
4           second means for providing a second self-pinned layer formed over only the  
5     central portion of the first means, an interlayer being disposed between the first and  
6     second means;  
7           a third means for providing a free layer formed in a central region over the second  
8     means; and  
9           a fourth and fifth means for providing first and second hard bias layers, the fourth  
10    and fifth means being formed over the first and second ends of the first means  
11    respectively, the first and second means abutting the third means, the first and second end  
12    of the first means extending under the fourth and fifth means at the first and second ends.

1           26.     A magnetic storage system, comprising:  
2           a moveable magnetic storage means for storing data thereon;  
3           an actuator positionable relative to the moveable magnetic storage medium; and  
4           a magnetoresistive sensor, coupled to the actuator, for reading data from the  
5 magnetic recording medium when position to a desired location by the actuator, wherein  
6 the magnetoresistive sensor further comprises:  
7                     a first means for providing a first self-pinned layer having a first magnetic  
8 orientation, the first means having a first end, a second end and central portion;  
9                     second means for providing a second self-pinned layer formed over only  
10 the central portion of the first means, an interlayer being disposed between the first and  
11 second means;  
12                     a third means for providing a free layer formed in a central region over the  
13 second means; and  
14                     a fourth and fifth means for providing first and second hard bias layers, the  
15 fourth and fifth means being formed over the first and second ends of the first means  
16 respectively, the first and second means abutting the third means, the first and second end  
17 of the first means extending under the fourth and fifth means at the first and second ends.